



**WWF**

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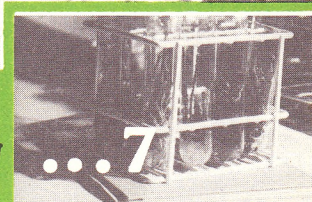


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# Comment

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WWF-INDIA is privileged to be able to interact with a wide range of supporters (subscribers, donors, programme participants etc). And, the organisation provides an information service to an even wider range of people including planners, administrators, journalists, legislators, voluntary agencies, educational institutions besides individual conservationists and researchers.

To enable it to provide this information support service, WWF-INDIA receives support from the Ministry of Environment & Forests, Government of India under their Environmental Information System (ENVIS) programme. The Data Centre for Natural Resources (DCNR) in Bangalore and the Environmental Services Group (ESG) in New Delhi are the two sister units within WWF-INDIA which act as data banks on conservation and environmental protection.

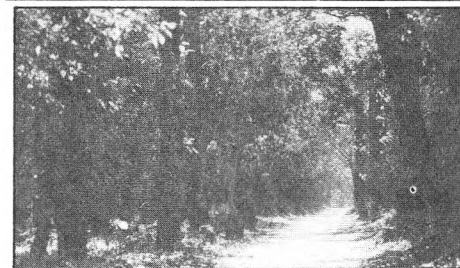
The kinds of information requests received may vary from technical queries on wildlife species and ecosystems, to information on other conservation groups, environmentally significant projects and availability of educational resource material. The ESG and DCNR together bring out a quarterly journal titled 'Environmental Resources Abstracts' that attempts to encapsulate a wealth of such information and bring it in a neatly packaged form to those interested in Conservation.

Subscribers are invited to use this information service by writing to either the DCNR or the ESG at addresses indicated elsewhere in this issue.

*Thomas Mathew*



**The views expressed by the authors are their own and do not necessarily represent those of WWF-India.**



The often encountered 'chemical tree' which if harnessed could become a vital renewable resource for the Chemicals' industry when fossil-fuels run out. Ironically, it is the emission of sulphur dioxide, a residual waste of fossil fuels that could endanger existing and future forests.

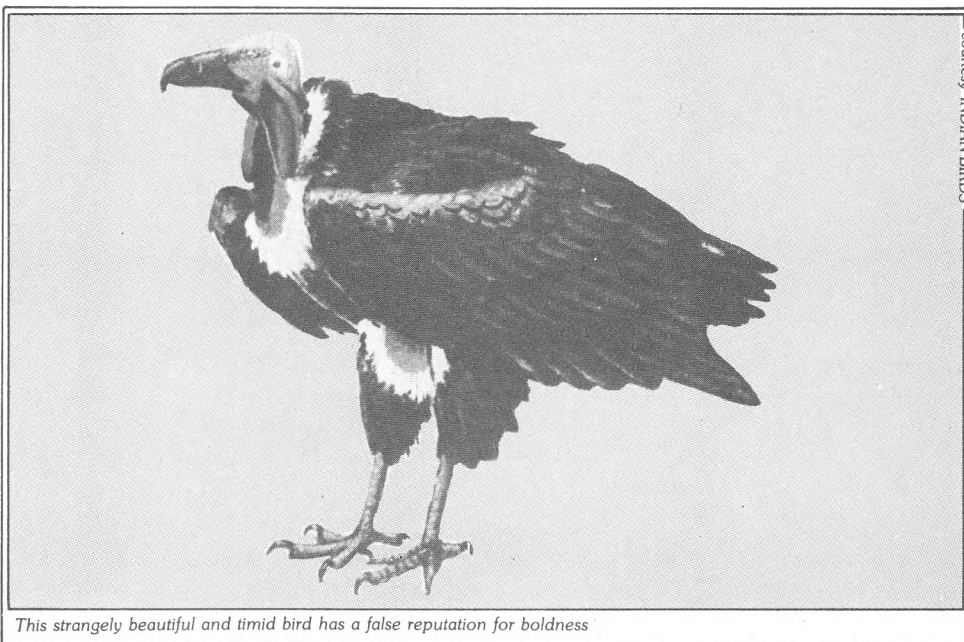
*Sarcogyps calvus* in Gujarat State

# Status of the King Vulture

SHIVRAJKUMAR KHACHAR — Chairperson, Saurashtra Committee, WWF-India  
TAEJ MUNDKUR — Pirotan-Motisari Project

**T**he King Vulture was a widely distributed species in Gujarat. It was no where numerically extensive but was frequently seen as the general pattern of the birds distribution with its extensive range in the Indian Sub Continent—common in the North and West and progressively decreasing towards the South and East with its stronghold in Rajasthan, Madhya Pradesh, Haryana, West Uttar Pradesh, Gujarat and parts of Maharashtra. The bird was recorded as being common but not abundant in Kutch by Dr. Salim Ali ('Birds of Kutch') and common in Saurashtra by Dharmakumarsinghji ('Birds of Saurashtra'). We have seen it frequently and at many places in Saurashtra and seen the nest at Jasdan (Devpura Veedi) and Bhavnagar (Victoria Park) as well as a spectacular courtship display at Hingolgadh near Jasdan. Dr. Salim Ali and M.K. Himmatsinghji have recorded nests at Mandvi in Kutch and M.K. Shivbhadrasinghji at Mitiala, Bhavnagar District.

During the last decade there has been a marked decrease in these Birds of Prey. The migratory eagles, buzzards, harriers and kestrels are no longer seen in the same numbers in Gujarat and in many other parts of India. We also noticed a very steep decline in the number of sightings of the king vulture along with many resident birds of prey especially the white-eyed buzzard. Sightings of the king vulture were rare and, whereas, it hardly merited a noting in bird diaries in the past, one started looking for it with anticipation. Alarmed at the lack of sightings we started an enquiry into the status of the king vulture in Gujarat. A pamphlet with a two colour sketch of the bird was sent to the Forest Department, members of the WWF, known keen bird watchers and ornithologists and the appeal was also published in the local newspapers.



This strangely beautiful and timid bird has a false reputation for boldness

This was in April 1982. Gradually, over the last five years, reports of sightings started coming in. The most frequent sightings were from the Gir Forest where twenty-two sightings were reported of thirteen pairs, three sightings of three birds (together), and one sighting of six birds. The highest numbers seen together in Gujarat were recently at Amrutvel, Gir Forest. (A.K. Banerjee). There are ten records from Kutch and eight from the Little Rann of Kutch. A nest was occupied with the bird incubating near Zainabad on the border of the Little Rann of Kutch (Elizabeth Forster) on February 27, 1987. Three records from Jamnagar and three from Barda Jam Raval of Jamnagar District. Two recent records in Rajkot District, at Saurashtra University, Rajkot (B.M. Parasharya) and Hinglogadh (Taej Mundkur), three from Bhavnagar District and one from Narol near Ahmedabad by R.M. Vadhavana.

Records from areas adjoining Gujarat

State are Mandu (M.P.) and Dhar (M.P.) by K.D. Bhuva and Chippabaeri, Mt. Abu, Rajasthan by M.K. Himmatsinghji.

There are no records from South Gujarat. From the numbers of records around the borders of the Little Rann of Kutch it seems that this area has a fair population of the king vulture like the adjoining State of Rajasthan. As all the records are from a couple of hurried trips to these areas (Lavkumar Khacher) a more thorough survey would, we feel, reveal many more birds.

We hope that readers will keep us informed of more sightings of the king vulture from Gujarat as also adjoining States in order to collect more data on this bird for a definite picture of its distribution and status.

We thank all officials of the Forest Department and other individuals including the late Dr. Salim Ali for their help.



# The Serpentine Song

MONA PARIKH

Project Assistant, WWF—India

*Will my child hear the song of a Koel as it sits on a peepal tree?*

*Will he know the joys of watching an Eagle in flight or Squirrels scampering in the grass?*

*And will he have a chance to feel the excitement of seeing a Cobra spread its hood majestically, or a Python coiling its beautiful body?*

*We are losing our wilderness and with it one of evolution's early miracles, ancestors of all mammals and birds—the reptiles, especially snakes are creatures most misunderstood, mistreated and disliked.*

Once an intricate part of our realm of mystery and magnificence, snakes are now disappearing at a more rapid rate than any other group of vertebrates.

"If the world goes on the way it is going it will one day be a world without reptiles. Some people will accept this calmly but I mistrust the prospect. Reptiles are a part of the old wilderness of earth, the environment in which man got the nerves and hormones that make him human. If we let the reptile go, it is a sign we are ready to let all wilderness go. When

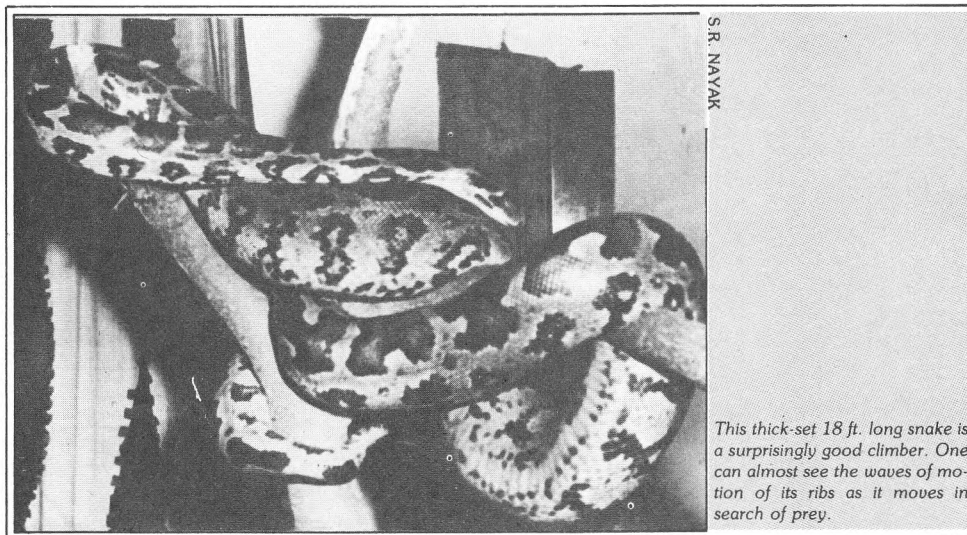
gold—the Indian Python brings life to your deadened senses, adrenelin flows, touching each cell made indifferent and dull over the months and suddenly you feel more alive as you watch that incredible life before you uncoil her long body.

Watch the snake for a little longer than a fleeting glimpse and a frightened getaway, watch its movement, observe its behaviour, admire its contours and colours or simply just look at it for a few minutes more and you might, you just might understand that special

## The Rock Python (*Python molurus*) (Or Indian Python)

The 'azgar' is distributed throughout India in dense and open forests with rocky outcrops. A lethargic slow-moving snake, the rock python is quite timid despite its intimidating size. In fact it rarely rouses itself seriously even to escape when attacked. When it does decide to move, it moves more like a large millipede than a snake. Instead of the normal 'S'-shaped locomotion of snakes, the python moves in a straight line; waves of motions of the ribs can be seen in quick succession. It may seem a little difficult to imagine, but this 19 feet long, 90 kg. heavy creature can climb and swim efficiently. If needed it can remain completely submerged under water for many minutes.

The Rock Python sleeps or basks in the sun during the day. Being 'cold-blooded' like all reptiles its body temperature varies with the external temperature, and only when its body temperature is the right degree will it feed, mate or show any signs of activity. Snakes feel pain and are actually sensitive to and can suffer from changes in temperature and humidity. About once a week, at night is hunting time. The python is on the prowl or lies in wait for prey near a waterhole or a regular mammal pathway. From a frog, monitor lizard or wild-duck to a porcupine, langur or young of chital or leopard, the python is aroused to activity on sighting its prey. As excitement and tension covet the still night, it advances with a quivering tail and flickering tongue, and lunges with an open mouth. One or two quick coils of the strong long body and the prey is suffocated to death. The python smells the dead animal all over (it is not known why it does this) and then, head first, swallows it whole. Since its jaws are loosely connected to the skull, great distensibility of the mouth is possible. The skin and scales on it are so constructed that stretching is possible to an enormous degree. Additionally the two halves of the lower jaw can move independently. All these factors aid the



S.R. NAYAK

*This thick-set 18 ft. long snake is a surprisingly good climber. One can almost see the waves of motion of its ribs as it moves in search of prey.*

that happens we shall no longer be exactly human" said Dr. Archi Carr.

Losing the mysterious, even dreaded, serpentine will be like losing a part of our spirit that deals with the wonders of human imagination, a mind that can travel into the days of dungeons and dragons, witches and fairies and all that is magical and mystical.

Imagine—a rounded silhouette, thickset in the middle, gracefully tapering, smooth glossy scales, head flattened, nostrils large, eyes small, pupils vertical, iris flocked with

quality, recognize that warm feeling within you and realize that the creature in its fragment of this doomed landscape must be saved. Saved for the sake of life itself, saved for treasuring the joys of life and with it an important part of ourselves.

Let us (in this issue) watch some of our threatened snakes. Under the Wildlife Protection Act (1972), the Pythons (Rock and Reticulated) and the Indian egg-eating snake are the only ones offered protection. However we shall also be looking at the King Cobra and the Flying Snake which are quite rare indeed.



python in swallowing large prey animals. After a meal, the python will not move until digestion has taken place and the hard structures excreted. If forced to move, the hard parts of the prey such as horns, or hooves could tear through its body wall, killing it.

The sensory pits found on the snoutshield and the first two lipshields distinguish the rock python from all other Indian snakes. These pits are very sensitive to heat radiation and help the snake in locating and capturing warm-blooded animals. This special sense is more effective than the sense of sight which is well developed especially in nocturnal snakes, like the python. The tongue has lost its traditional function of taste and has become the carrier of scent particles to an organ called Jaconsn's organ found on the forked tongue. As far as hearing goes, it is practically non-existent. Recent studies show that airborne sounds are picked up through the snake's lungs, however vibrations conducted through its lower jaw is a more effective substitute for hearing.

The Rock Python normally mates once a year around Dec-Jan-Feb and for the first time when it is about 5 yrs old (and 11 ft. long). Snakes find their mates by means of a strong musk from the cloacal musk glands, each species has its own scent. This explains the belief that if you kill a snake another (its mate) will follow and take revenge. What actually happens is this—when you kill a snake it expels its musk from the anal opening; it is possible that another snake might pick up the musk scent (sex-attractant) and show up to investigate.

Mating in snakes has often intrigued people, and the 'dance' (vertical twining) observed sometimes between 2 members of a species, is actually a ritual combat between male snakes and not mating. It is a likely result from a sort of territorial dispute, though no one has been quite able to explain this activity.

During mating the male crawls on top of the female after a period of arousal procedures including rubbing and biting. The male has a

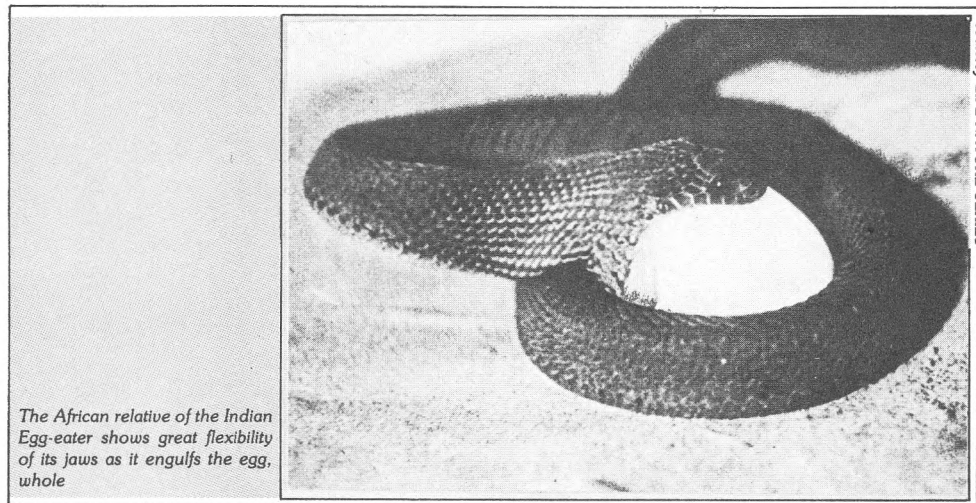
this constant by shivering, when the air temperature makes it necessary. The eggs hatch 58 days later, after which the mother takes no further interest in her brood.

Growth is fairly rapid in the first few years, slows down later but is a continuing process. This takes place by the process of 'sloughing' or shedding the skin. Healthy snakes shed their skin five to six times a year and this is

there is no hope for the Indian Python or any other wild species.

## The Reticulated Python (*Python reticulatus*)

This longest known snake in existence growing upto 30 feet long and weighing 114 kg. is distinguished from the Indian Python by the larger number of sensory pits and their



The African relative of the Indian Egg-eater shows great flexibility of its jaws as it engulfs the egg whole

often one complete elegant operation. Initially the snake becomes dull and lifeless, its eyes cloud over and it loses its appetite. Many seek water to soak themselves as they lose a good deal of body liquid along with the old skin. Shedding starts when the snake loosens the skin around its lips by rubbing its mouth against a rough surface. Gradually as the creature crawls through scrub and over rocks, the thin outer layer is peeled off inside-out like a glove. Finally, sometimes in less than half an hour, the snake is completely free of its old skin; a little longer, larger and glistening with its glossy new skin, and unfortunately it is this very skin that is the undoing of the Indian Python. Hunted ruthlessly for its beautiful skin, it has become locally extinct in many areas. Though it is a protected snake, the protection is not complete. Permits for procurement and commercial use of its skin can be and are issued by State Chief Wildlife

presence on the 3rd & 4th lipshields. In India it is only found in the forests of East Assam and the Nicobar Islands. Its survival, like that of other snakes depends upon the protection of its habitat and its skin.

## Indian egg-eating snake (*Elachistodon westermanni*).

This small, very rare snake probably the rarest of all Indian species is closely related to the African egg-eating snake, about which there is a little more documented information than our variety. Practically nothing is known about the Indian egg-eater. For a small handleless creature to engulf a big, smooth oval egg seems next to impossible, a feat comparable to a man swallowing a melon whole. The accomplishments of this snake are imposing and intriguing. Nature has provided it with a distensibility of the mouth greater than that of any other snake, and with its very elastic mouth it swallows the egg whole, aided by small knob-like teeth which are useful only for gripping the smooth egg. Sharp projections from the neck vertebrae rip the shell open as it goes down the throat. And then there are a special set of muscles which regurgitate the shells, while a valve keeps the liquid egg-contents down. An incredible result of nature's technology is this small (800 mm in length) olive-brown—black snake with yellowish vertical scales and white-flecked sides having a white belly and a yellow stripe along the top of the head from snout to mouth and yellow lips.

Only a few specimen are known from India

..... contd. overleaf

**"Understanding the nature and role of these animals may be the first step towards changing the common, destructive and wrong attitudes about them"—Romulus Whitaker**

paired evertable penis in the tail and during mating one is inserted into the female's cloaca. It is impossible to normally differentiate the sex in snakes since the sex organs are found internally. After a gestation period of 3-4 months, the rock python will lay anywhere from 8 to 100 eggs. The mother demonstrates parental care and she incubates her eggs by ceiling around them. Her body temperature is higher than normal and the brooding snake keeps

Wardens. Hope for the Rock Python lies in the Export Policy for Wildlife Products (75-76) which is a better protective legislation for Indian snakes. Under the new law, export of all snakes or their products are normally not allowed. Special licences for export are only issued for scientific research. Habitat destruction leading to decline in the numbers of Indian snakes is a more complicated and difficult matter to control; but without which



..... contd. from overleaf

(North Bengal & Bihar). It would be fascinating to get to know this little-known snake. If anybody has seen this snake or has any information, please write to us.

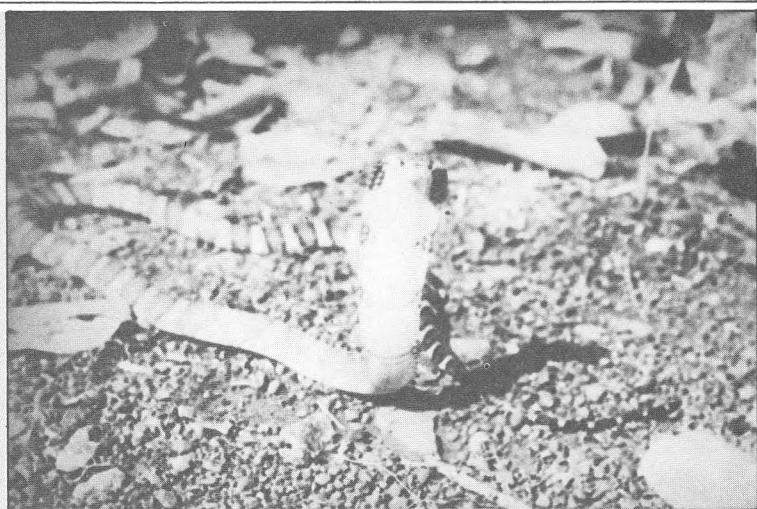
## King Cobra or Hamadryad (*Ophiophagus lamnah*)

'Who is the deadliest of them all?' 'King Cobra' say most (though the krait may actually be deadlier). It's aggressiveness and courage are said to be unique among Indian snakes, since it is sometimes reported to attack unprovoked. But again some say that the King Cobra even when guarding its nest will seek to escape when encountered; unless injured or cornered it's instinct is to get away. It would be an attribute related to individual temperament, (not very different from man, wouldn't you say?) while one may attack with great determination, another may hastily slink off. It may be this unpredictable nature of the Hamadryad that makes it so intriguing to snake lovers who would claim to know it well and to others who would like to understand it better.

A royal looking, snake, the King Cobra (appropriately), commands attention. When threatened the snake will erect its body to about one third of its 18 feet length, spread its hood and bite, determinedly; holding on tenaciously as it pumps poison with a chewing motion of its jaws. And its poison is deadly. A quantity equivalent to ten lethal doses to man could be discharged at a bite. Considering the size of the snake (3rd largest in India) and the vehemance of its attack a sublethal dose is highly unlikely. Death has been recorded in less than 20 minutes.

One may question here the validation of saving such a dangerous creature. The truth is that it is a creation of God or of nature, or of

One-third of its magnificent body erect, the Hamdryad is in striking pose



evolution (what you believe is irrelevant) just as man is. It is very much a living part of this complex web of life in which every thread is of significance. For the more practical minded, the fact that snake venom today is being used in the study of diseases and to make many life-saving drugs should be good enough reason to save the Hamadryad and other venemous snakes.

Onto less dramatic but equally interesting facts about the King Cobra—it is the only snake in the world that builds a nest. A female starts a nest of leaves, hooking in the leaves with a loop of her body and piling them up. Sometimes sand is also brought into the nest heap by loosening it with a tilted head and raking it in with a loop of the body. A chamber is then made inside the pile as the snake revolves its coiled body in the middle of the structure. Eggs upto about 50 in number are laid 5-6 weeks after mating, in the central chamber and covered with a layer of litter. The female then coils up on top of the leaf-covered clutch—another instance of maternal care in

snakes. The King Cobra has a special diet—It only eats other snakes, including the poisonous ones. It is known to move fast but cannot overtake a running man as is sometimes alleged.

It is a rare snake in India and is confined mostly to the dense forests of the Western Ghats, Orissa, Bengal and Assam. It is the destruction of the King Cobra's dense evergreen rain-forests habitat that is causing its decline.

## Flying Snake (*Chrysopelea ornata*)

Another snake worth a mention and found in the forested hills of south-west and the forests of northeast India, north Bihar and Orissa is the rare beautiful Flying Snake.

This slim, quick, fast and colourful snake exudes vibrant energy. Its name attained by its gliding motion. Ribs extended, belly pulled in, flattened, the snake can glide from tree to tree. An instance is recorded of the species gliding a distance of about 50m—another marvel of nature. It eats frogs, lizards, small birds and is even seen to take bats. The black skin beautifully marked with yellow in white cross bands, a sprinkle of red rosettes and greenish belly is unfortunately very popular with snake fanciers in Europe and America; and is therefore exported in large numbers.

Ecologically one of the most important roles known of snakes is that of a 'rat-predator'. In fact they are so efficient at controlling this destructive pest, which is destroying 20-50% of India's food grains that they are often called the farmer's best friends. The use of pesticides will never be as effective as snakes because of the grave danger of chemical absorption in crops itself, and eventually causing harm to man.

Mona Parikh has been involved in various projects at the Jersey Wildlife Preservation Trust. She has also worked with captive snakes at the Sundarvan Nature Park, Ahmedabad.



A graceful and agile climber moving from branch to branch, this diurnal Flying Snake is probably on the look-out for geckoes or lizards.



# Trees for Chemistry

JOHN EMSLEY

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*Wood is a source of food, fabrics, paper and many other domestic products. In this article John Emsley explains how various by-products of industrial importance can be extracted from components of wood such as cellulose & lignin.*

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**T**he Earth produces more than 12 billion tonnes of wood a year. This is twice as much as we consume each year of fossil reserves. When oil and gas start to run out, trees could provide valuable chemicals to supplement and eventually replace those from oil and gas. In the next century, products such as textiles, plastics, drugs and dyes, currently derived from petrochemicals, could come from trees. Even now, wood, not oil, provides some of these raw materials. Synthetic fabrics such as rayon, packaging materials such as cellophane, rubber and some plastics come from wood.

In the past, we have taken this natural resource too much for granted. We still regard trees chiefly as a fuel and a source of paper rather than as a source of chemicals. This is a mistake. Fast-growing trees planted now would reach maturity as oil reserves dwindle. In Europe, the economics of exploiting wood as a material resource would depend on what policy Europe adopts for reforestation.

At the moment, Europe is far from self-sufficient in wood. Forest cover in EEC countries is relatively low, on average 23 per cent of the total land cover. It ranges from 5 per cent in Ireland to 45 per cent in Greece. Both the European Commission and the Ministry of Agriculture in Britain are planning to turn redundant farmland into forest.

The policy-makers envisage several kinds of tree-farming, including growing traditional woods for timber on less fertile land, in areas such as Wales, northern Scotland, western Ireland and Brittany. Even in these regions, any major change in land use would affect the ecology of Europe. For all potential new sources of energy and materials, we have to analyse the benefits versus the environmental costs very carefully.

Planting trees does not have to mean acres of conifers. Although the chemicals' industry requires wood pulp of good quality from trees such as spruce, pine and fir, even some broad-leaved trees such as poplar, sycamore and birch are also suitable for pulp.

Some nice statistics favour trees as a chemical resource. For example, it would take only five trees to clothe one person for a lifetime—three, if we use all the wood from the tree. One tree could furnish a family with enough clothes, carpets and curtains for a year. Rayon, which comes from wood, could replace many textiles derived from petrochemicals, such as polyester, nylon and acrylic fibre. Indeed, during the Second World War, the Germans developed a continuous process for manufacturing rayon, now used worldwide, that made them independent of imported fibres.

Although trees are already an important feedstock, industry uses less than half the tree, mainly in the form of cellulose for paper and textiles.

Clearly, if wood were to go some way to replacing oil, it would make economic sense to exploit all the constituents of wood. Several research groups both in universities and in industry are looking at ways of using the whole tree. Some ideas promise to revolutionise the attitude of the chemicals' industry to this primary resource.

How could we use the whole tree? Wood has a complex structure which could provide some interesting chemicals from the four basic materials comprising wood. Cellulose constitutes roughly half the bulk of wood. Hemi-cellulose makes up a fifth, lignin a quarter and resin, or oil, accounts for the remaining twentieth. Cellulose, the basic structural element of the cell wall, is a carbohydrate made up of chains of glucose rings. This polymer may be more than 10,000 glucose units long. Hemi-cellulose is a more complex polymer made up of a mixture of sugars such as xylose, galactose and arabinose, as well as glucose. Lignin is a mixture of interconnected molecules of derivatives of benzene. It constitutes most of the intercellular part of wood. The minor components of wood, the oils, are hydro-carbons such as turpentine derived from isoprene, which is a product of the tree's metabolism.

## Chemical options

The extraction of these constituents requires several stages. First, the pulp mills chop the logs into tiny pieces and treat them with steam. This releases the turpentine as a vapour. One of two processes breaks down the wood chips chemically, depending on what the manufacturers want to produce. The major industrial process, the Kraft process, employs sodium sulphide and sodium hydroxide to solubilise the lignin leaving an insoluble pulp of cellulose and hemi-cellulose. The pulp is suitable for making high-quality paper. The addition of acid to the liquor produces the lignin (which paper manufacturers just throw away) and the oils from the wood. These oils float on the surface of the remaining liquor and are skimmed off to produce "tall oil" (from the Swedish word for pine). Manufacturers separate this into various components such as distilled oil, fatty acids, resin and pitch, all predominantly chemical derivatives of complex hydrocarbons.

An alternative method of treating wood, called the sulphite process, turns wood into a pulp that is suitable for making chemicals. Sulphur dioxide and calcium or magnesium oxides produce a cellulose pulp, liquor containing derivatives of lignin, called lignosulphonates, and hemi-cellulose. Both the Kraft and the sulphite process have a problem. They use evil-smelling sulphur compounds which, if left in the waste products, pollute the environment.

Although, the wood-pulp industry has made great strides in housekeeping by recycling these materials, it would obviously be better to find an alternative way of breaking down wood. One new method, developed by Raymond Young of the University of Wisconsin, employs a mixture



of acetic-acid, ethyl acetate and water to digest the wood. The result is a liquid separated into two layers—an organic layer containing the dissolved lignin and a water layer that retains the cellulose and hemi-cellulose.

Cellulose is currently the most important product from the digestion of wood. For 90 years, the chemicals' industry has been converting cellulose, without any chemicals modification, into viscose for rayon fibre and cellulose sheets—'Cellophane' is the well-known trademark. Wood pulp, when treated with sodium hydroxide followed by carbon disulphide, reacts to give a viscous solution of polymers called xanthates. When neutralised with acid, these revert to a finer quality of cellulose that chemical manufacturers can spin into fine fibres or extrude into a transparent film.

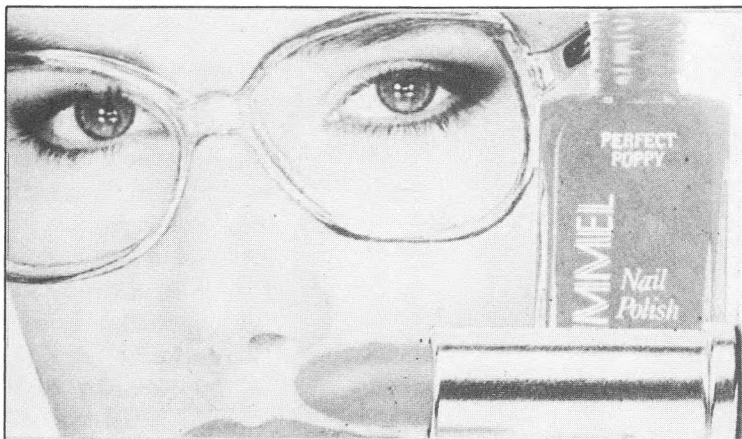
These chemical processes tend to break down the chains of polymers so that the resulting fibre is weaker than it might be

### Breaking new ground

The British company, Courtaulds, is researching into better ways of producing fibre. The company, which is a major producer of rayons and the largest manufacturer of cellulose film in the world, is developing a new breed of cellulose fibre that is longer and therefore stronger. The trick is to dissolve the pulp in a solvent called N-methyl morpholine oxide. The company hopes that cellulose produced in this way might compete with synthetic fibres from oil, such as nylon. However, the success of the process depends upon efficient recycling of the expensive solvent, together with changes in the fibre-spinning technology.

Chemists can also modify cellulose by exchanging some of the hydroxyl groups around its glucose rings for other groups such as acetates. The resulting polymer, acetate rayon, is ideal for lining material but can also be transformed into solid plastic. Although acetate plastic cannot compete in price with oil-based plastics, there are some uses where the "feel" of the material is more important, such as spectacle frames and tool handles.

Cellulose does not dissolve in water, but chemists can convert it into soluble derivatives by changing some of the hydroxyl groups of the glucose rings into carboxylates or ethers. Monochloroacetic acid ( $\text{ClCH}_2\text{CO}_2\text{H}$ ) reacts with cellulose to give acidic polymers which when neutralised form soluble sodium salts. These ionic polymers make good thickening agents for many modern products such as emulsion paints and instant desserts.



Resin is commonly used in the preparation of cosmetics, while the more expensive acetate is preferred in the production of spectacles for its sheer comfort.

Chemistry can convert the hydroxyl groups of cellulose to methoxy ( $\text{CH}_3\text{O}$ ) to make ether cellulose, by treating cellulose with monochloromethane under pressure. Surprisingly these polymers are not only soluble in water, but are also loathe to let any water escape from their chemical clutches. They crop up in diverse products from cements and wall-tile adhesives to potato croquettes. Both cellulose

polymers are food additives with designated E numbers—E466 and E464, but you can think of them as added fibre.

The biggest use of soluble cellulose is as an additive in washing powders where they comprise about 1 per cent by weight. The ionic polymer makes up most of the additive, which clings to the surface of cotton garments, preventing dirt from adhering to the fibres. The rest of the additive is cellulose ether, which clings to polyester fabrics making them hydrophilic (or water-loving) and so easier to wash.



The thickening properties of cellulose polymers are suitable for many diverse products such as instant foods and emulsion paints.

### The wider approach

Chemists can produce more novel soluble polymers from cellulose. Courtaulds is developing a range of polymers based on, for example, ethyl cellulose, which could replace polymers made from petrochemicals. These materials include polyvinyl acetate or alcohol, used to size fabrics, polyacrylic acid, which is a thickener and flocculating agent, and polyvinyl pyrrolidone, a resin used in cosmetics and lacquers.

After cellulose, lignin is the main component of wood. It is also the main waste product of the pulp industry, which disposes of 30 million tonnes of lignin a year. Although there are some uses for lignin, most is burnt or dumped into rivers. The byproducts of lignin such as the lignosulphonates from the sulphite process, have certain adhesive and protective qualities. Their chemical inertness towards water and oxidation make them suitable for using in cement. One chemical made commercially from lignin is the food flavouring vanillin or vanilla. Although supposedly the most popular food flavouring in the world, it accounts for little of the total lignin produced.

Lignin is the great untapped chemical resource. Chemists and biochemists have been trying to find ways of degrading lignin into useful chemicals. The main constituents of lignin are benzene rings, so lignin could provide industrially important aromatic compounds normally obtained from oil, such as benzene toluene and ethylbenzene. These are essential bulk chemicals and precursors of plastics such as polystyrene, and fine chemicals such as dyes. However, breaking down lignin into simple compounds is difficult. One approach is to use enzymes from the fungi that naturally rot wood. So far this method has not been very successful. A far better approach is a chemical route called electrochemical oxidation.

Jim Utley and his group at Queen Mary College, London, have successfully obtained from lignin one compound, 4-hydroxybenzaldehyde, that is a potential intermediate for the pharmaceutical and plastics industries. Much more exciting is the prospect of controlled degradation, so that the lignin breaks down into short chain polymers. These could act as sequestering agents to inactivate metal ions, and so could find a role as water softeners in detergents. This process will one day yield commercially valuable chemicals.



### The sweet side of wood

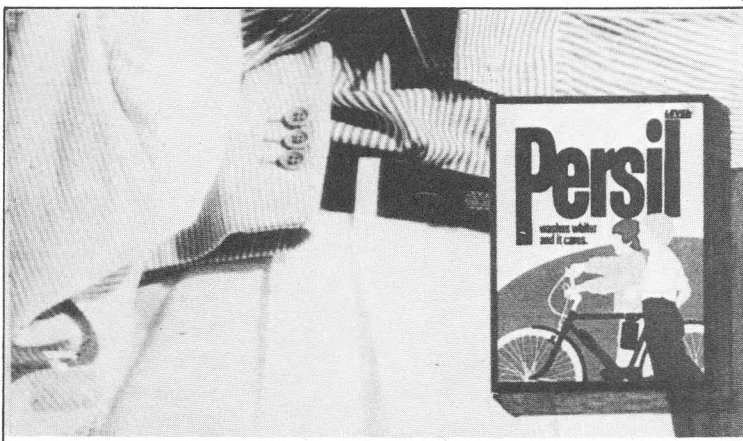
The other main constituent of wood, hemi-cellulose, is almost as plentiful as lignin. Hemi-cellulose chains are branched, and have a low molecular weight, so they are not suitable for converting into fibres. However, hemi-cellulose, in particular that from hardwood trees which is mainly a polymer of xylose, is a source of sugars. Chemists can turn xylose into xylitol by hydrolysing and hydrogenating it. Xylitol is as sweet as sugar. The Finns have long used xylitol, which they call birch sugar, and now export it to the EEC. A Finnish company called Xyrofin is marketing the sugar as an alternative sweetener. Unlike sucrose, xylitol does not encourage dental caries (*New Scientist*, 10 September, p 36), so it makes an ideal sweetener for mints, throat pastilles and chewing gum.

It should also be possible to break down cellulose into its component sugar, glucose, but the process is slow. ICI has recently developed and patented a chemical method using hydrochloric acid, calcium chloride and lithium chloride. The company thinks that glucose will be an ideal feedstock for its single-cell protein process. An alternative approach is to employ cellulases—enzymes that digest cellulose to glucose. Certain fungi, such as *Trichoderma reesei*, produce cellulases but are not efficient. Recently a group of scientists at the Solar Energy Research Institute (SERI) at Golden, Colorado, reported that they had found a new cellulase, produced by the bacterium, *Acidothermus cellulolyticus*, in the hot springs of Yellowstone National Park. Remarkably the bacterium works best at 75°C in an acid solution of pH 5. The new enzyme outperforms all existing cellulases, which lose their activity above 60°C.

Once chemists come up with a viable chemical process to convert cellulose into glucose, a well-developed fermentation technology exists for turning glucose into ethanol, which in turn could be converted into ethylene—one of the main precursors of the chemical industry. Ethylene is the starting material for many products such as polyethylene and ethylene glycol.

### Stretching our resources

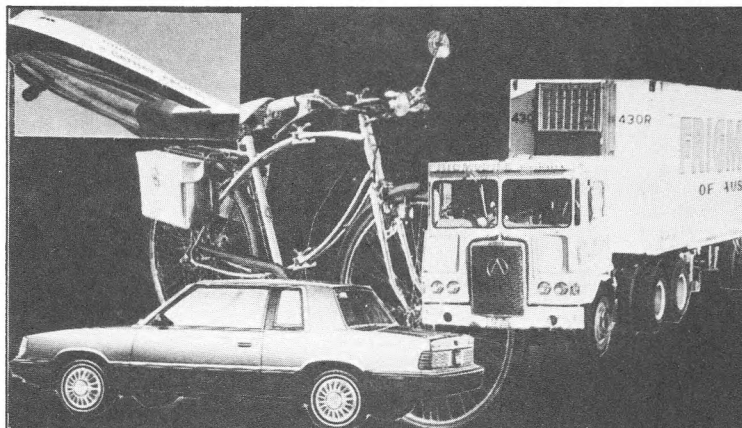
Ethanol is not the only alcohol we could obtain from carbohydrates such as cellulose. In 1910, the French chemist Auguste Fernbach, discovered that fermentation would turn starch into acetone and butanol. Chaim Weizmann, who went on to become the first president of Israel, developed the process when he was a chemist at the University of Manchester. He also isolated the micro-organism responsible *Clostridium acetobutylicum*.



Rayon has long been used in garments: the hydrophilic properties of soluble cellulose find compatible use in washing compounds.

His work proved invaluable in both world wars. In the First World War, acetone, a raw material used to make the explosive cordite, was in short supply; in the Second World War, butanol was scarce. This alcohol is a starting material for butadiene which chemists can convert into synthetic rubber. In both wars, corn starch was the source of carbohydrate, but carbohydrate from wood would do equally well. So when the oil has

gone, trees could not only supply natural rubber—and remember a fifth of the world's supply of rubber still comes from rubber trees—but the fermentation of cellulose may also supply the butadiene for synthetic rubber.



Synthetic rubber through fermentation of cellulose supplements the current demand for natural rubber against tyres in the automotive industry.

### Viable applications?

What other hydrocarbons could wood supply? Although turpentine and tall oil are hydrocarbons, they are limited in value for fuel. Research by Leonard Lewko of a Canadian company 'Weyerhaeuser' in Saskatchewan recently proved that tall oil could replace diesel oil, but not at competitive prices.

The conversion of cellulose, however, into hydrocarbons would be an attractive way of making oils from the abundant part of the tree. Roger Benn and Noel McAuliffe of the University of Manchester, Institute of Science and Technology have been working on a process that will produce some acceptable fuel for boilers, from cellulose wastes such as paper and sawdust. The process heats the waste to higher temperatures at high pressures, which converts the groups again converted into hydrocarbon groups and carbon dioxide.

Heating the wood under normal pressure decomposes its carbon, and drives off a mixture of volatile organic liquids chiefly methanol, or wood alcohol, and acetic acid. A tonne of wood will yield 500 litres of these volatile liquids. The residue is charcoal. Wood kilns still operate in the USA making 750,000 tonnes of charcoal for barbecues every year. Whereas, once the volatile liquids, given off during heating, were an important source of chemicals, today they merely burn off. James Diebold, also of SERI, estimates that a tonne of sawdust could produce 250 litres of petrol, simply by heating the sawdust and passing the organic vapour over a zeolite catalyst.

In New Zealand, the petroleum company, Mobil, already turns methanol into petrol, with a zeolite catalyst, ZSM. The same catalyst could convert distillates from wood burning into petrol, long after oil wells run dry.

Currently the trend in the world is still to move away from wood as a resource for chemicals. New pulp mills are for paper and increasingly for fluff—to meet the demand for disposable nappies. The last mill in Britain that made paper specifically for the chemical industry closed down a few years ago. Yet wood will become important in the post-oil era and maybe sooner. It has one great advantage over fossil fuels—it contains very little sulphur so is environmentally safe. Ironically it is the emission of sulphur dioxide from fossil fuels, which appears to be partly responsible for the acid rain that could endanger the cultivation of new forests in Europe—a major chemical resource in the future.

John Emsley is a reader in chemistry at King's College, London.

Courtesy *New Scientist*





Mr. D.N. Ghosh inaugurating the MREU with the traditional breaking of the coconut.

## Maharashtra

### BOMBAY

The State Bank of India has donated Rs 2.5 lakhs against two 'jeeps' to be utilised as Mobile Rural Education Units in the States of Maharashtra and West Bengal.

Mr. D.N. Ghosh, Chairman, State Bank of India, handed over one of these jeeps to Admiral M.P. Awati, Chairperson, Maharashtra and Goa Committee, WWF-India at a function held on February 6, 1988 in the Central Office (Bombay) of the Bank. Mr. Ghosh expressed the hope that optimal use would be made of the vehicle towards dissipation of information in the rural areas and that the purpose of such a unit be fulfilled in the best possible manner, not forgetting maintenance and care.

The body of the jeep has been specially designed and constructed to accommodate equipment such as a generator, cine-projectors, audio-visual equipment, public address system, etc., that have been bought through funds raised by WWF-India. The pro-

ject envisages a greater impact in rural education covering a wide range of topics such as alternate energy sources, conservation measures and solutions relating to problems of rural concern.

Hindusthan Cocoa Products have in collaboration with WWF-India (in consultation with the Maharashtra & Goa Office) introduced Cadbury's Wildlife Bars in November 1987. Currently these chocolate bars are being sold throughout India. Each chocolate bar features two relief figures of wild fauna, and the wrapper too carries a colour reproduction.

Totally, there are twelve species of fauna depicted. The scheme also includes a wildlife poster given free against the purchase of two wildlife bars, and six such posters are being made available.

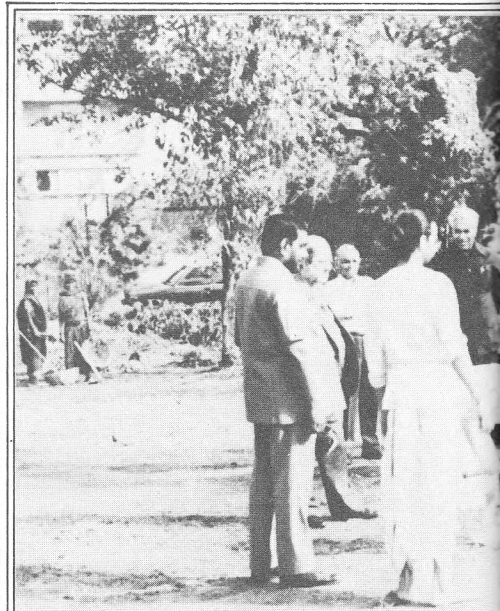
Under the agreement Hindusthan Cocoa Products Ltd., will be forwarding a percentage of the revenue earned through these sales to WWF-India. A similar agreement was drawn-up earlier between Cadbury's (U.K.) Ltd., and WWF-United Kingdom which was met with

much enthusiasm. It is hoped that our subscribers and wellwishers patronise this product as it would mean substantial support to WWF-India, as well.

### NAGPUR

The Divisional Organiser, "Nandu" Andhare, organised a subscriber function at the Sinchan Sewa Bhawan. Two films which form part of the serial "The Living Planet" were screened on the occasion. He also addressed the gathering on the plans for the year and the importance of their renewing their annual Subscription.

A subscriber educational outing was also organised to Pench National Park. Subscribers trekked along nullahs to study tracks and signs. Pench National Park is well stocked with wild animals and a variety of Birds. Pugmarks



Mrs. Anne Wright MBE, Trustee-Eastern Region 'breaking ground' of Nature and National Resources, Lodi Institutional Area ceremony was initiated by the WWF-India President Lt. Col.

of tigers, leopards, civet cats, wild dogs, and sloth bears were observed. Subscribers were also taken to the catchment area where they saw large cormorants, large grey herons, median egrets, harriers, blue winged teals, darters, honey buzzard, etc. A large number of raptors such as the crested serpent eagle, the crested hawk eagle kestrel were also observed. Pied Hornbills were also observed.

Mr. Pallav Bagla, environmentalist, showed subscribers his collection of slides on tropical forests. He also addressed the gathering on the devastating effect of the Narmada Sagar Dam.

Subscribers were exposed to a session on Astronomy by Mr. J.B. Kewate, a subscriber. In the clear sky that one sees in a forest, the stargazing experience was a treat.



Cadbury's innovative wildlife bars, and with their wrappers. The sales would help earn revenue for WWF-India.

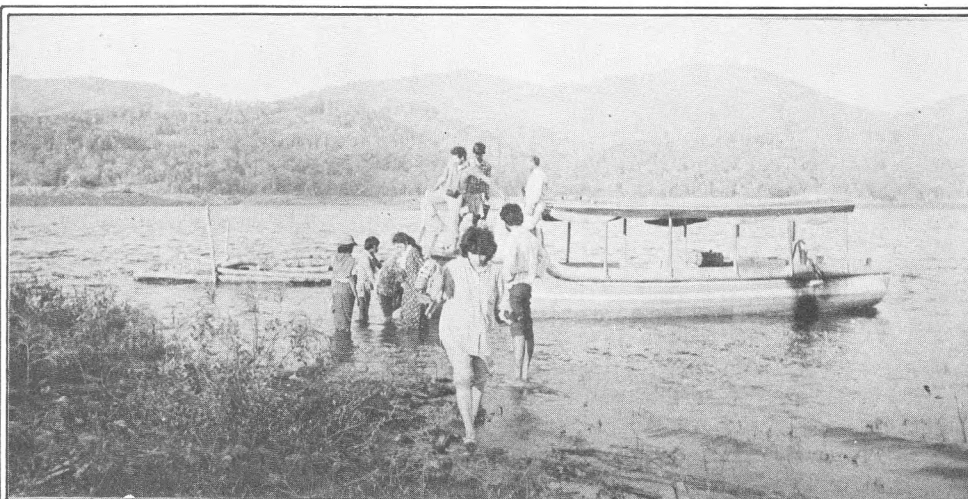


## Kerala

### TRIVANDRUM

Ten of the fourteen administrative districts in Kerala State were represented at the first State-level Nature Orientation Camp organised by the Kerala State Office of WWF-India. The three-day camp held in December, at the picturesque Parambikulam Wildlife Sanctuary in Palghat district, was led by Dr. Satishchandran Nair and his wife, Dr. Shanti Nair.

This Office recently inaugurated its first one-day Nature Camp at Kumarakom near Kottayam. Participants were taken to the 'enchanted island' of Pathiramanal by boat where they saw a large flock of migratory ducks



Participants of the 3-day camp after cruising the Lake comprising the Parambikulam Wildlife Sanctuary.

courtesy N. C. THOMAS

The highlight of their tour was Niarara Island, part of the Marine National Park in the Gulf of Kutch. Here they observed many marine creatures like the octopus, puffer fish, sponges, jellyfish, shrimps, etc. They learned how coral were formed and watched pelicans, flamingoes, oyster catchers, crabplowers and many other birds. Mr. Taej Mundkur of Rajkot was their guide and he explained how the destruction of mangroves had not only affected man, but the sea creatures too as they had lost their food, shelter and breeding grounds.

The sessions in each programme included:

- Types of fuel & its management.
- Conservation of fuel while cooking.
- Health of women and use of fuel.
- Using renewable energy resources for meeting fuel needs.
- Role of women in conserving nature.
- Fuel in relation to environment, and

Ms. Tanuja Desai, State Education Officer and M.N. Naik Hon-Secretary, Gujarat State spoke on 'Fuel Management'. They illustrated the talk by means of charts, exhibits, and small models. The charts showed cooking methods, quantum of fuel used, health hazards and improved devices for cooking.

The Gujarat Energy Development Agency provided some exhibits of solar cookers, 'io-gas plants, solar hot-water system, 'Nirdhum Chula', solar photovoltaic cell, etc. These exhibits were displayed at each of the centres and a detailed explanation given by Dr. M.N. Naik. All the exhibits were impressive and the need for preparing good models of systems to explain the participants in detail was keenly felt.

## Gujarat

### BARODA

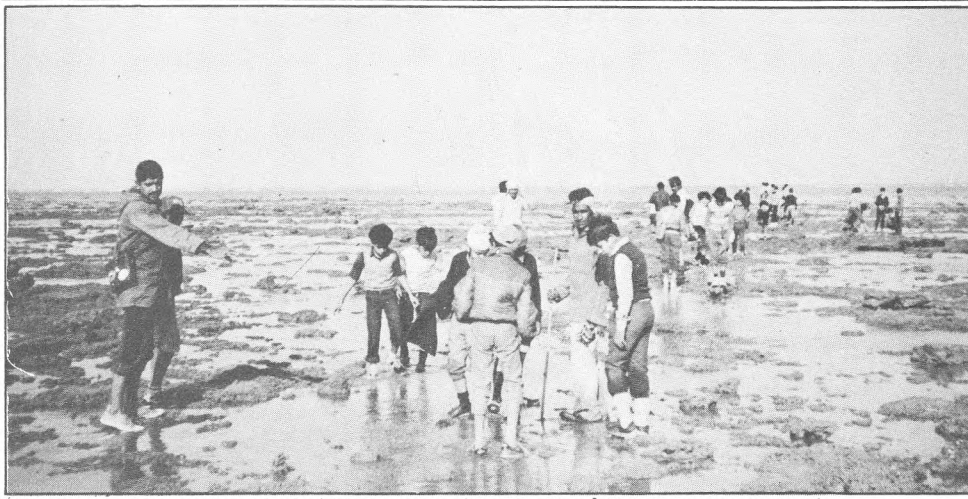
The WWF-India, Baroda Division has introduced Programmes for the rural community to create awareness amongst the people. 'Fuel Management for Women' project" was organised during Feb '88 with financial assistance from Baroda Citizen Council, Baroda at Patod, Ranapur, Gayaj, Timbarva and Kayavarohan.

numbering around 10,000 birds, skimming the surface of Vembanad lake. Later, they were shown the famous "heronry", the nesting colony of night herons. Unfortunately, the members could not stay longer to see the birds awaken and leave their roost to forage in the paddy fields.

## Madhya Pradesh

### INDORE

The Daly College Nature Club organised a 'Coastal Awareness' tour to acquaint its members with Gujarat's cultural heritage and natural wealth. They visited Ahmedabad, Rajkot, Jamnagar, Dwarka, etc., Sasan Gir, Somnath and the Marine National Park on Niarana Island.



Mr. Taej Mundkur on Nihara Island advising members of the Daly Nature Club (Indore) on marine life.

courtesy DALY N.C.



## PESTICIDES CREATE MONSTER BUGS

Scientists at an American Association for the Advancement of Science meeting in Chicago have suggested that the misuse of pesticides has inadvertently created "strains of monster bugs" that can no longer be chemically killed.

"There are now about 30 species that nothing can kill", according to Robert Metcalf, a biology professor at the University of Illinois.

Brian Croft, a professor of entomology at Oregon State University, said the problem threatens agriculture and health around the world and costs US\$2 billion annually.

According to United Press International resistant strains result from the survival of pests that are able to develop enzymes that detoxify a pesticide or slow its penetration.

The scientists suggest that the current method of controlling insects which usually involves developing a new pesticide and then saturating the intended victim, actually results in making an insect immune. They offered two examples:

Malaria had been nearly eliminated from many parts of the world until the World Health Organisation (WHO) decided to eradicate it by using insecticides.

All it had to show for its effort, he said, was "a race of malaria carrying mosquitoes virtually immune to insecticides".

Cotton bollworms were a second example. "Most of them were fairly well regulated by their natural predators and when we started throwing pesticides all over the place, we killed our friends".

Metcalf and Croft contend these cases need not have happened and that prudent "integrated pest management" chemicals may prevent future occurrences. The technique involves the alternate use of various pesticides and the reintroduction of natural predators. • •

## CORRUPTION KILLS

Eradication of corruption instead of chasing poachers or halting international trade, is the key to ending rhino poaching, according to Dr. David Cumming, Chairman of IUCN's African Elephant and Rhino Specialist Group.

According to a story published in "Pachyderm", the group's newsletter, Cumming says that "the pivot of illegal and uncontrolled exploitation is the mafia-like alliance between the corrupt politician, the corrupt businessman and the corrupt bureaucrat."

The fears that rhino have all but been eliminated from the Selous Game Reserve have now been confirmed. Black rhino are currently being poached in the Zambezi Valley at the rate of one a day".

Cumming suggests that emphasis must now be placed on eliminating the corruption that permits the rhino horn trade to flourish. "The first step is to identify the pivotal individuals," he says. "The next is to break the alliance, through whatever means are

### ENVIRONMENTAL AMNESTY NEEDED

What Amnesty International does for political prisoners, a new "Environmental Amnesty" should do for natural resources, according to IUCN President Dr. M.S. Swaminathan. He suggests such an organisation could act as a 'watchdog' for abuses of the world's natural heritage.

"Human rights violations affect individuals, but human heritage violations cause genetic damage, since their harmful impact will extend to generations yet to be born". Like political Amnesty, he says the proposed Environmental Amnesty would be politically neutral and professionally credible.

Swaminathan would also like to see an international code for sustainable and equitable use of natural resources while maintaining economic growth.

He says that such an idea will not work without the full support of governments, media and the public and he would like to have 'people's associations' for sustainable development. • •

most appropriate, and so stem the strong local, sometimes regional, demand for the horn and illegal ivory."

These steps, he says, are generally beyond the

means of conservationists and wildlife officials. "They require the involvement of heads of state and key professionals at both the national and international level." • •

## CONSERVATION PAYS

Convincing policy-makers that conservation pays takes a dollars-and-cents approach. In Rio Macho, development alternatives are being compared in purely economic terms, and conservation is winning.

Rio Macho is a large forested reserve in central Costa Rica. It supplies half the drinking water for the densely populated central valley, as well as contributing substantially to the country's hydroelectric power resources.

In an experimental project, IUCN and CATIE are currently evaluating Rio Macho's natural resources from a strictly economic viewpoint, to see which of

several management regimes would be of greatest long-term benefit to the country. For example, should it be exploited for timber and converted to farming and cattle ranching? Or should it be fully protected, to continue providing water and power and to conserve genetic resources? Or does the greatest benefit lie in some middle ground; i.e., to zone and distribute the forest for a variety of purposes, allowing selective exploitation of its timber and medicinal plants, and operation of such small non-destructive enterprises as bee-keeping and nature-oriented tourism.

The goal of the project is to demonstrate in solid economic terms the range of values the forest can

yield to Costa Rica's economy, and to determine which provides the maximum long-term benefit. It aims both to demonstrate the practical benefits of conservation to economic development, and to bring a much-needed economic perspective to traditional conservation efforts.

The Rio Macho pilot project will be used as a model for subsequent projects in other Central American countries. Indeed, if the programme succeeds in convincing economists of the dollar-and-cents value of tropical forest conservation, it could have a profound influence on forest conservation efforts throughout the world. • •

## GREEK FORESTS IN PERIL

Conservationists have expressed alarm over a recent decision by the Greek Government to pass a bill which will drastically reduce the country's already-endangered forests.

The bill, introduced by the Ministry of Agriculture, has freed 61 percent of Greece's remaining woodlands for grazing. According to critics of the decision, over 300 man-made forest fires were rag-

ing out of control in anticipation of the new law being passed while the bill was being debated in Parliament. During a single week, over 10,000ha of forest land went up in smoke.

"The passage of this law could be the finishing stroke for much of the Greek forests," said Dr. Peter Kramer, Director of Conservation for WWF International. "None of the economic or ecological pro-

blems were taken into account before the law was drafted."

Conservationists contesting the bill claim the new law is unconstitutional and intend to challenge it in the country's Supreme Court. A special executive committee has been formed to exert national and international pressure on the government to repeal its decision. •



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## 'USAID'—CHANGE OF HEART

The U.S. Agency for International Development (USAID) say that nine Third World development projects worth more than US\$2 billion have been abandoned or delayed because they pose threats to the environment.

The findings, based on surveys by the agency's field staff and on information from the World Bank and other multilateral banks, indicate that Western

donors are succeeding in their efforts to halt environmentally risky projects or modify them to minimize harm to forests, soil and water reserves. The multilateral banks had planned to provide more than \$900 million for the nine projects.

The largest project being delayed, India's \$1.2 billion Narmada River development, needs to be re-examined and "await environmental clearance" by

the Indian Government, the report said.

The report indicates that two projects—India's Cauvery River development and a Haitian tree-planting plan—have been cancelled because of World Bank decisions. USAID warned that the Haitian project could "lead to destructive land use and exploitation". \*

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## BLOW TO POLLUTION CONTROL

Moves to reduce air pollution and acid rain foundered at a meeting of the UN Economic Commission for Europe (UNECE) in November 1987. The Executive Body had been expected to agree to limit emissions of nitrogen oxides (NOx)—key components in the formation of acid rain and photochemical smog—but failed to do so.

Consensus on a binding protocol to control NOx pollution would have been a constructive follow-up to the much-feted ratification of the Sulphur Pro-

tol which entered into force on 2 September 1987. NOx, like sulphur emissions can travel for more than 2,000km as an airborne pollutant, and is regarded by many scientist as just as dangerous to the environment. The Sulphur Protocol, also known as the '30 Percent Club', provides for a 30 percent reduction of 1980 levels by 1993.

### NOx freeze

Delegates at the UNECE meeting rejected a pro-

posal from Switzerland, West Germany, Austria, the Netherlands and Sweden that there should be an immediate freeze on NOx emissions, to be followed by a 30 percent cut by 1995. It now appears that agreement may eventually be reached in 1988, but that it will actually allow for an increase in NOx pollution for many years to come. \*

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## ENVIRONMENTAL EDUCATION LIFELINE

Starting last autumn, every school in the United Kingdom now receives a free newsletter from WWF once a term. *Lifelines* consists of four pages of useful information about environmental education for teachers, whatever subject or age group they teach. Presented in newspaper format with a stylish black-and-white design, the articles and photos show how WWF's educational projects and publications can be, and are being, used to increase young people's awareness and understanding of environmental and development issues.

Since 1980, WWF-UK's Environmental Education Programme has focussed on generating materials to help teachers bring a new perspective to their everyday classroom work with children from 5 to 18 years old. This was in response to the World Conservation Strategy which called for changes in people's attitudes and behaviour so we may all live in harmony with the natural world on which we depend for our survival and well-being.

The programme aims to give young people the

necessary knowledge and experience that will enable them to make informed judgements about environmental issues. It also motivates them to get involved in practical activities.

This means maximizing the potential through English, art, religious education, history and social studies as well as geography and biology. The materials are produced from direct classroom work, from groups of teachers and experts well-versed in both the subject matter and education. \*

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## PLANTS HELP 'AIDS' RESEARCH

Researchers in the United States working on cures for cancer and AIDS will be helped by a new drug isolated from the seeds of a Queensland, Australia, rain forest tree (*Castanospermum australe*) black bean.

The curator of the Brisbane Botanic Garden, Ross McKinnon, says his office was contacted by researchers in August of last year. They requested 100

kilograms of the seeds which are large and roundish and about 2.5-3.5 cm in diameter.

The irony is that black bean is a species that has been severely depleted through logging.

Like a large number of native plant species, it has not been fully examined for possible medical uses. Apart from an abortive attempt some years ago to

conduct a detailed study, much of the research work on the tree is being done outside Australia.

According to Bob Johnson, Director of Botany at the Queensland Department of Primary Industries, "If we continue to let species die, we could be losing great medical break-throughs." \*\*

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## SOMETHING FISHY!

Suppured by studies showing high fish oil diets may cut chances of heart disease, medical researchers are planning five years of intensive tests on fish oil food supplements.

"Fish oil may offer great promise in reducing cardiac risk and may even have benefits unrelated to heart disease," said Dr. Craig Miller, Associate Professor of Cardiovascular Surgery at Stanford University Medical Center.

United Press International reports that the new study, expected to take about five years, will be funded by an US\$11 million grant from the National Institute of Health.

Fish oil being marketed in concentrated capsule form may be "too good to be true," Miller said. The capsules contain amounts of concentrated fish oil that could only be duplicated by eating a large amount of cold-water fish, which is what Green-

land Eskimos do. A 1977 study of Greenland Eskimos traced the population's low incidence of heart disease to its high consumption of fish oil. Further studies showed that when some of the Eskimos moved to Denmark and changed diets, cardiac risk went up. \*\*

\* Courtesy: WWF News  
\*\* Courtesy: IUCN Bulletin



# Mauritius and Khemraj Sooknah

UMA RANGANATHAN

*This island with the fantasy beaches and wildlife may not remain the way it is too long according to Khemraj unless people are made aware of the dangers of development, unless they decide to take action against the destructive measures that follow in its wake. That is precisely what he has set out to do: to make the options clear to the people before it is too late. "The one thing that the conservation programme in Mauritius needs is a big boost".*

**I**t's been a great trip by any standards". The evidence is Khemraj Sooknah's beaming face as he relates his experiences in India, as he talks about the train and bus rides across the country, his trips into the forest, not to mention the long discussions with WWF stalwarts in various areas he has visited. During the hectic six weeks that Khemraj recently spent in India he has managed to put together enough material and ideas to boost his own wildlife conservation programme, back home, in Mauritius.

After completing a training course in Cheltenham, U.K. and working with the Jersey Wildlife Preservation Trust, Khemraj returned to Mauritius in March 1985, with the intention of waking up fellow Mauritians to the environmental needs of their country. "Our problems, in a sense, goes back more than a hundred years." Says he "It probably started around 1840 with mass migrations from India and Africa. Various plants and animal species began to be introduced into the country which inevitably rivalled the native species for land and food. In many of the battles, the local birds and beasts unused to competition unable to protect themselves and slow to reproduce, soon began to die out, the dodo being a prime example, followed by the pink pigeon which lost the fight against the Indian mynah."

Over a period of time, trade and settlement led to increasing destruction of forest land, of the marine environment and consequently to changes in the traditional lifestyles of the people.



A very disarming Khemraj Sooknah on his visit to the Secretariat

Khemraj recalls the idyllic childhood he spent in his native village, Plaines des Roches. The 300—odd families lived comfortably off the land, rearing cattle or selling the abundant fruit which the surrounding trees offered. 'Progress' however, was soon to catch up with the village. When Khemraj returned from his studies after a ten-year gap, sometime in the eighties, he found that the government had pushed through a scheme to build an airport in the vicinity. This as well as a move by private sugar industries to fence in the forest, ended up by barring villagers' access to what had been their own land. "Today," says Khemraj, "people here are unemployed. Since they ran short of land and of fodder, they had to sell their cattle. The only milk available now, is the powdered stuff which sells for

Rs. 15 a litre which obviously few can afford. And the wild fruit which we used to love as kids—well the children don't know it any more. They don't know what a jamun is, because it is all marketed in the towns by the sugar mills."

Since his return from the U.K., Khemraj has set various ambitious environmental conservation programmes in motion, part of whose objectives are carried out by the Wildlife Clubs of Mauritius (WCOM). The 55 clubs which have sprung up in the last two years or so, have through various projects and exhibitions managed to share their experiences and their knowledge with the public. Educational projects for school children for example, include the study of the world around them the rivers, the plants, the animals



and environmental problems as well.

A project which seems especially interesting, is one which acquaints school children with population growth. A questionnaire is distributed among the children. This in turn makes them think of population in relation to housing and available space and the environment. At what age would you marry; goes the questionnaire; How many children would you like to have; How many rooms would you need in your house to accommodate all the people; How much land would be taken up if everybody in your neighbourhood had the same sort of

house; In what way would the surrounding area change; And so on. School children work out answers to these questions, calculate individual and group needs over a period of time and in the process become aware of the vital connection between population control and the need to preserve the environment. Their efforts are then publicised through articles in the local newspapers as well as through exhibitions and discussions.

One of Khemraj Sooknah's pet projects is the establishment of a nature reserve close to his native village, where various species of birds will be introduced, where

children can be taken on nature trails and where they can get acquainted with the local flora and fauna.

Khemraj expects that his trip to India, sponsored by the ICBP (International Council for Bird Preservation) and the US Wildlife Research and Fisheries, will provide him with practical ideas on setting up new clubs back home and providing them with a better structure. The agreement between WWF-India and Wildlife Clubs of Mauritius also includes the start of a joint venture to publish much needed educational materials in Mauritius.

### Excerpts from a booklet by Khemraj Sooknah "Mauritius - Island of Natural Treasures"

Mauritius was formed through a series of volcanic activities, colonised by plants and became a refuge for animals, birds and turtles which had to change their ways of life. Such changes gave birth to new species. One species of birds, the *Dodo* was found on Mauritius. The *Dodo*, a coastal bird was the result of island evolution. It lived in harmony with other animals and plants found on the island until man decided to land and settle on the island.

Human settlement led to the destruction of the fragile ecosystem of the islands as massive clearance of endemic forests made way to agriculture. History explains the extinction of at least 20 species of animals and probably about a hundred species of plants. Endemic life is now limited

*The forests of Mauritius have undergone tremendous changes over the past years. Only 0.5% of the total area can be labelled as native. There are many factors which are destroying the endemic life of the island. Some of them are as follows:*

1. *The Introduction of exotic animals, such as monkeys and mynah birds are destroying the nesting sites of endemic birds.*
2. *Rats and mice are destroying the seeds of endemic trees.*
3. *Endemic seeds can not grow as they experience a suffocating effect by the introduced exotics.*
4. *The rate of reproduction of exotics is faster and higher than endemic species.*

The habitat of the island is ideal for growing palms. One of the world's most endangered palm continues to thrive in the botanical garden of Curepipe. It is the sole survivor on Mauritius and in the world.

Lantans are also species of interest for island reptiles. These beautiful lantans are remarkable for their huge fan-shaped leaves. Rarely seen in the wild, they are grown in private and botanical gardens. The colourful Vinson geckoes are found living on the crown of this lantan.

The Mauritius Fruit Bat is the only surviving endemic mammal which continues to thrive in the upland forests. It is larger than the average bat. The body is covered with golden fur whilst the wings are black. This species was severely hunted and its population ranges to about 300 only.

The Kestrel lives in both the upland and lowland forests. It is the only raptor on the island and is endangered. It feeds on lizards, geckoes snakes and little birds. The chest is covered with white feathers with golden heart speckles. The wings are brown with black stripes. The population in the wild is about 30. A captive breeding programme has been set up to save these birds.

The Pink pigeon, probably the most beautiful pigeon is a cousin to the *Dodo*. Its chest feathers are pink but the wings are dark brown. The beak and legs are reddish. The current population in the wild is about 20. A captive breeding programme has been set up to save this bird from extinction.

The Echoparakeet is the most endangered parrot of the world. It is green in colour and is larger than the Ring Neck Parakeet of India. The male has colour stripes on the neck. Its population is declining

On the north coast of Mauritius is a dome shaped island. This is Round Island. It is remote and isolated. On this island, lives the famous Round Island Skink. Its population is threatened due to lack of vegetation and suitable nesting sites.

On the same island, there exists an endemic gecko. This gecko live on the tops of the Round Island Bottle Palms. It feeds on insects, nectar and pollen of the bottle palms. This gecko is endangered as there exists only few suitable habitats.

Another interesting reptile on this island is the primitive boa. Two species exist on the island—(*Casarea dussumieri*) the Keel Scale Boa and the Round Island Boa. It is interesting to note that both boas are egg-laying species.

Two species of palms are found on Round Island. These are the Bottle Palm and the Hurricane Palm. These palms are the original flora of the island and contribute to the niches for the reptiles on the island.

In the past, there existed many turtles along the coasts of Mauritius. Sadly, the presence of the turtles on the coasts is a rare sight nowadays. Some individuals can be found along the southern coasts. Man has destroyed its nesting sites. Turtles are also victim of the tourist trade.

Lately, many species of shells are endangered. One species, Lambis, is the victim of the tourists trade, as it is collected and processed into bedside lamps. Such a practice has almost eliminated this species from many parts of the coastal belt. Removal of shells has resulted in the sudden increase of sea urchins and other marine animals likely to cause injury while swimming.

Big game fishing is a fast growing tourist attraction. 'Catching a Blue Marlin' is regarded a challenge and lifetime ambition. This fish lives in the deeper waters of Mauritius. During the fishing seasons hundreds are slaughtered, through gaming, for pleasure. No regulations are enforced upon the size of the catch. Population estimates are still very vague.

# Eco-Development of the Mahabaleshwar-Koyna Watershed Region

*Mahabaleshwar and Panchgani are not merely pretty tourist spots. They are also the centre of a major watershed for three large reservoirs: the Koyna, the Dhom and the Kanher. Unfortunately, nearly all of the natural vegetation in this part of the northern Sahyadris has been destroyed.*

## Recent Action

Following an initiative made by officials of the Forest Department, the Koyna west bank forests have been declared a protected sanctuary. And, at the deforested northern end of the Koyna lake, a pilot scheme is in progress to reforest privately owned lands, by leasing them from the owners.

Following a public initiative in Mahabaleshwar, a Regional Plan has been drafted for the region around Mahabaleshwar and Pan-



Monsoon-fed pool of water laced with silt due to steady top-soil erosion as a result of deforestation

ly, the legal effectiveness of the regional plan is mainly confined to building restrictions, and it cannot fulfil the need for a positive program of environmental development that makes it worthwhile for local inhabitants to grow suitable plants and trees instead of cutting and burning the hillside vegetation.

## The Present Situation

Mahabaleshwar's forests are steadily deteriorating, due to persistent cutting of branches and young trees by the local inhabitants. Despite all the public fuss of the past few years, the cutting goes on unabated, and the local authorities are unable to do anything about it, under present government policy and the current administrative system.

Excessive building goes on at a reduced though still dangerous pace, which yet greatly overstrains the local capacity for maintaining the environment.

Outside the built-up areas, farming and village communities still lack any means of development that is beneficial to the environment. The problem is that present rural development programmes in Maharashtra are mainly designed for the agriculture of relatively fertile valleys and plains, which provide an immediate commercial return. Such programs are unsuited to the North Sahyadri watershed, where slopes are steep and where the soil is poor and very easily washed away. Some sort of commercial return may be possible here, once suitable plantations have been identified and established; but it will require scientific investigation and long term investment, because the returns will not be immediate. In any case, the primary need in the North Sahyadris is not for direct commercial return, but for watershed protection. Even where direct commercial return is not possible, as it may not be on the

exposed crests of the mountains, reforestation and forest protection are an essential long term investment, along with the construction and maintenance of dams and reservoirs. But at present, though there are government programs for wasteland development and watershed protection, these programs have not been effectively implemented, particularly in major watershed areas. The major watersheds of the North Sahyadris continue to be neglected, under the currently established system of government policy and administration.

## What Can be Done Now?

The Government has already formulated an integrated eco-development plan for the Western Ghats, with a sub-plan for Maharashtra. This plan urgently needs to be put into practical effect in particular districts, by setting up special administrative machinery to co-ordinate the work of different government departments and other agencies. Here are a few suggestions for the Mahabaleshwar-Koyna region in Satara District.

1. The Additional Collector's function in Mahabaleshwar-Panchgani should be extended to include environmental development and protection of the entire North Sahyadri watershed in Satara District, including the Koyna, Dhom and Kanher catchments. Such watershed reforestation and maintenance will require the co-ordination of many government agencies, in particular the Zilla Parishad, the Forest Department, the Irrigation Department, the Agriculture and Horticulture Departments, the PWD, the Tourism and Urban Development Departments, and so on. Moreover, co-ordination will also be required with scientific research and development in-



stitutions, voluntary agencies and private initiatives. Such government and non-government co-ordination would require the full-time administrative work of an Additional Collector, appointed with special powers for the purpose. He should set up a long-term program for watershed reforestation and protection, including both constructive development and regulatory policing, and he should himself be responsible for administering the execution of this program. And most important, this post should not be subject to frequent transfers.

2. For the purpose of long-term planning, an in-depth study should be made of the local economy and society, not merely by compiling statistics but by competent social scientists who would spend considerable time with the local people, interviewing them and observing their way of life. In particular, the study should ask how people can be educated and compensated to develop and protect the environment, or, alternatively, how people can be successfully and humanely settled elsewhere if they so wish.

3. Given the current lack of knowledge about suitable plantations for the North Sahyadri region, a scientific research program will be required to identify and develop suitable plant species and techniques of cultivation. First, existing data will have to be collected from current research stations and pilot plantations in the Koyna valley and on the Mahabaleshwar-Panchgani plateau. Second, available knowledge will have to be put together to provide an overall picture of the local climatic and soil conditions and of how the natural ecosystems of slope and crest have adapted to these conditions. Third, a co-ordinated program of further research and pilot projects will have to be planned and put into time-bound effect. So far, pilot plantations have mainly been eucalyptus, silver oak, acacia and casurina. These are ecologically unsuitable and have thus been failures in the exposed areas of the Mahabaleshwar plateau top, with its high winds and extremely heavy monsoon rain. On the less exposed Panchgani side of the Mahabaleshwar plateau, and in the Koyna Valley, eucalyptus and similar plantations have been more successful, but their soil protecting ability and suitability is a matter of controversy, and the matter needs further study before more plantations are tried on a large scale. So, for both the crests and the slopes of the North Sahyadris, further scientific research is essential to any serious program of plantation and reforestation.

4. Given the extreme scarcity of the last few remaining pockets of natural forest in the

North Sahyadris, these precious few pockets should be preserved with the greatest of care and should not be cut at all, either for commercial exploitation or for providing land for pilot projects. Fuel and timber should be brought from commercial plantations and other sources outside the sensitive watershed area; and pilot plantations should use already deforested land, of which surely there is no lack.

5. In Mahabaleshwar's forests in particular, all collection of forest wood should be totally banned, and the ban should be seriously enforced. To compensate the local inhabitants for this ban, a generous allowance of firewood or other fuel should be provided to each household free of cost, and those who have licenses to collect dead wood for sale should be further compensated by alternative work or by generous cash payments. There are only a few hundred such licencees. The pretense of collecting dead wood has long been used as a cover for wholesale forest cutting; and the inability to provide the local inhabitants with alternative fuel. There will be some vociferous local opposition to a strictly enforced ban on forest cutting and collection, but if the government shows that it really means business and compensates the local inhabitants adequately, the opposition will soon die down. To help enforce a ban on forest cutting, the government should take over all local distribution of firewood and should ban the transit of lorries carrying recently cut wood through Mahabaleshwar. Such through transportation of wood is quite unnecessary, because there are perfectly feasible alternative routes; and the pretense of through transportation is regularly used as a cover for smuggling out wood that has been illicitly cut from protected forests.

6. There should be a sustained follow-up on the establishment of the Koyna forest sanctuary, and any tourist use of the sanctuary should be carefully controlled

so as not to disturb the forests or the wildlife.

7. Hill stations and holiday places alternative to Mahabaleshwar and Panchgani should be established and developed in a highly controlled fashion, with a co-ordinated, long-term plan in view for the entire watershed region. Now that readily motorable roads are making the Koyna valley more and more accessible, its natural beauty is likely to start attracting tourists over the coming years; and any such tourism needs to be properly organised and regulated from the beginning, in order to make it beneficial rather than destructive to the environment, in particular, being strictly regulated from the beginning, in order to make it beneficial rather than destructive to the environment. In particular, only a strictly regulated number of hotels and restaurants should be allowed in each particular place, and other facilities for tourism should be carefully controlled,



*The hills of Mahabaleshwar are rapidly being denuded for commercial exploitation.*

8. A tourist information and education service should be developed, in order to encourage awareness and appreciation of the environment. Such a service could well include many educative facilities that are totally lacking today. In particular, it should not be too difficult to produce useful maps and interesting literature, to set up tourist information centres, to train and license adequate guides, to arrange nature trails and hiking trips, and to display educative exhibits in an interesting way in environmental showrooms and museums. Such facilities are quite common-place in the developed world, and in this matter of environmental awareness we in India cannot afford to be backward any longer.

*We regret that "Eco-Development of Mahabaleshwar-Koyna Watershed Region"—Part-I in the previous issue was incorrectly ascribed to Shiraj K. Sataramalla*

—Eds.

*'The Save the Western Ghats Movement' has produced as a follow-up, a booklet that attempts to provide guideliness to non-Governmental organizations (NGO) and individual activists as well as village level workers to cover the following:*

- *protection of the remaining forests in Western Ghats.*
- *regreening of the denuded hills with endemic species.*
- *protests and representations against large-scale projects that displace local peoples*
- *undertake awareness programmes by means of traditional and modern media.*

**This handbook for NGOs is currently available at Rs. 3/- only.**

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## **ACCOLADES**

*Mr. Samar Singh, Secretary, Personnel, Administrative Reforms and Training, to the MP Government has been awarded the "Order of the Golden Ark".*

*He has been selected for this internationally acclaimed award for his out-standing services rendered in the field of nature conservation.*

*The former Prime Minister late Mrs. Indira Gandhi and late Dr. Salim Ali the renowned ornithologist have had the distinction of having been decorated with the coveted award.*

*The investiture ceremony took place at the N. Delhi-based Embassy of the Netherlands by Mr. Eegie M Schoo, the Ambassador of Netherlands.*

*There are three categories of the award. While Mrs. Gandhi had received the award of the highest category, Mr. Singh was be decorated with the award of the second category. Similar awards were presented to Mr. Billy Arjan Singh of the Dudhwa National Park (UP) and Mrs. Anne Wright, MBE, Trustee, Eastern Region.*

## **Peace and National Security**

*Military activities swallow up large chunks of the budgets—and environments—of many Central American countries; political and territorial conflicts have long thwarted the region's attempts to develop and prosper.*

*Two important new concepts have recently emerged in Central America which may greatly affect the region's chances for long-term economic and environmental prosperity.*

*In 1949, Costa Rica abolished its armed forces, which had previously consumed as much as 22% of its annual budget. Most of the money previously spent on armies and armaments was rerouted to other sectors: health, education, energy, agriculture, water supply, and to the development and protection of the country's natural resources and environment.*

*Has Costa Rica sacrificed its national security? Hardly, says Dr. Rican Quesada, Director of the Costa Rican National Conservation Strategy for Sustainable Development.*

*"We are simply redefining the concept of national security, from the ability to wage war to the ability to prosper in peace. It is no longer based on weapons but on the welfare of the people and their ability—and freedom—to be productive."*

*"A society needn't be rich to provide basic services for its people," continues Quesada, who has been developing the idea for the last two years, "it must simply use its resources wisely. When social needs are fulfilled, the social tensions that make armies necessary do not arise, and the climate is right for the democratic participation of the people in the decisions that affect their future."*

*Rapidly gaining favour and support throughout the region is the innovative notion that international peace parks should be established in border areas to ease tensions, protect threatened ecosystems, and provide an opportunity for positive action and cooperation between countries which in the past were often in conflict.*

*La Amistad International Park in southern Costa Rica will become such a peace park if plans to extend it into Panama are realized. Other parks being proposed include the Biotopo Trifinio on the common border of El Salvador, Guatemala and Honduras, and the Moskitia rainforests on the border between Nicaragua and Honduras. There is also increasing interest in establishing a "Natural Reserve for Peace" along the border between Costa Rica and Nicaragua.*

## **CITY LIGHTS GO OUT**

*According to reports from South America, President Alan Garcia Pérez of Peru plans to bar new factories and companies from the Peruvian capital Lima in order to prevent that city from becoming like Calcutta, which he describes as "a city of total and absolute misery".*

*New measures include granting tax benefits to the provinces in order to encourage businesses to move to other parts of the country.*

*Lima is home to one-third of the country's 20 million people and by the end of the century its population is expected to grow to 12 or 14 million.*

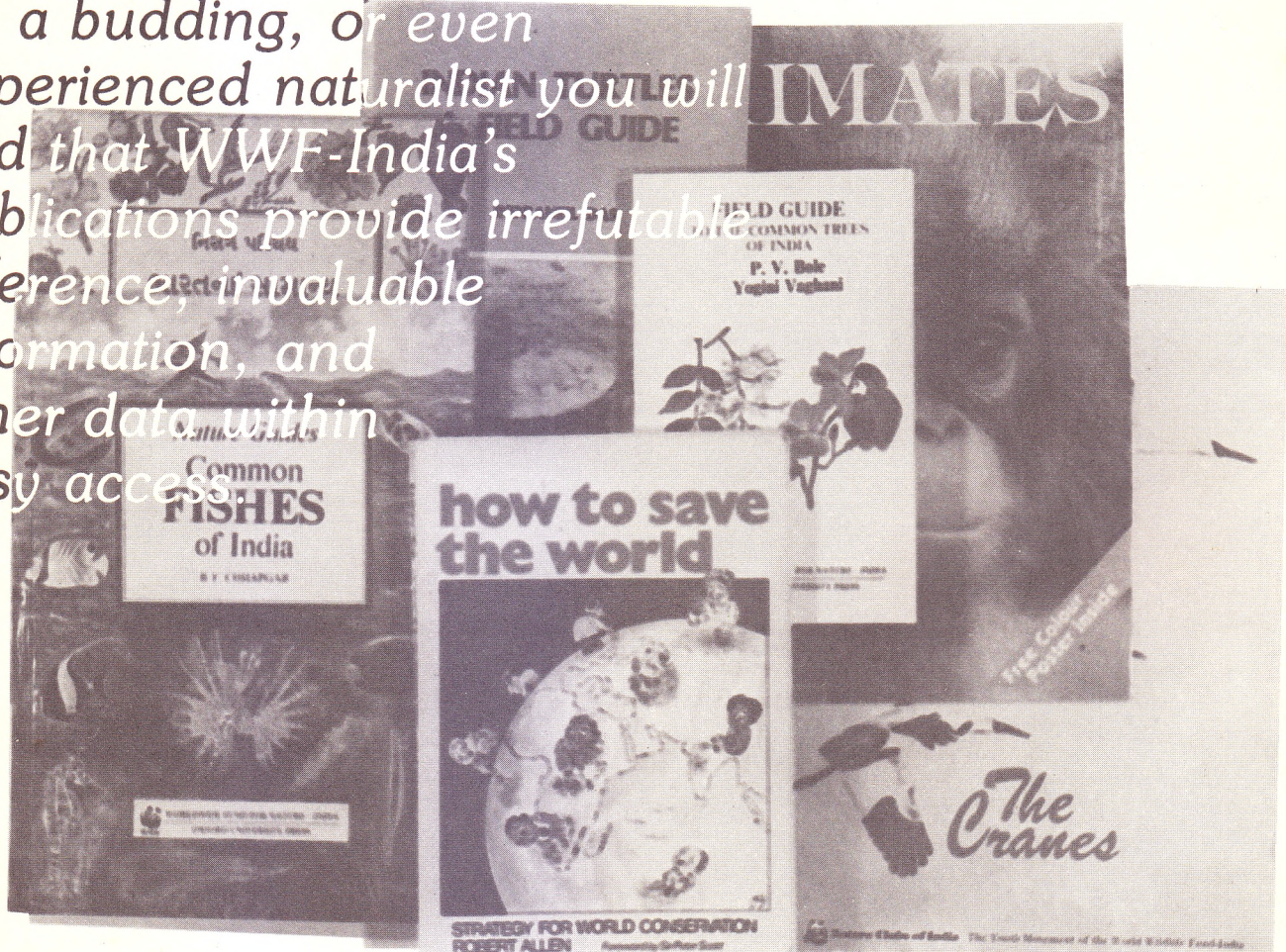
*President Garcia fears that by the year 2000 "we'll be more than 30 million people who will be much poorer and on the edge of more misery, crime and violence".*

*The President said the Government could grant a tax holiday and lower electricity rates for factories in the provincial cities and would fix a date after which no new factories or concerns could be set up in Lima.*



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